Arithmetic Patterns

Apply the skill to decisions and designs

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QUICK REVIEW

Check at least two changes before naming a pattern. In $2, 7, 12, 17$, each term increases by 5: $7 - 2 = 5$ and $12 - 7 = 5$. In the 4 times table, $4, 8, 12, 16$ also increase by 4 and every total is even.

Worked example

Continue $2, 5, 8, \square, \square$. State the rule.

1. The difference is $5 - 2 = 3$ and $8 - 5 = 3$.

2. Continue: $8 + 3 = 11$, then $11 + 3 = 14$.

Answer: $11, 14$; add 3.

Practice Problems

Show your thinking.

1. A plant is 11 cm tall. It grows 3 cm each week. List its heights after $1, 2, 3$ weeks.

2. Complete the last two outputs. Explain how the outputs change.

Input	Output
1	8
2	16
3	24
4	☐
5	☐

3. Look at the first four multiples of 6. Are they all even, all odd, or alternating? Explain.

4. Two partners must have 10 counters together. Their pairs are $(1, 9), (2, 8), (3, 7)$. Extend the pattern by two pairs and explain what changes and what stays fixed.

First partner	Second partner	Total
1	9	10
2	8	10
3	7	10

5. Figure 1 has 3 tiles; each new figure adds 2 tiles. Design figures 2 and 3, then predict figure 5.

6. A hall adds one row of 4 chairs each day. It starts with 8 chairs. On which day will it first have 20 chairs? List the daily totals.

7. Create a four-number pattern that starts at 5, adds the same amount, and ends at 20. Find the step and both middle numbers.

8. A game starts with 7 points and adds 4 points per turn. A player says an even increase must make the next total even. Test the next three totals.

Answer Key

1. $14, 17, 20$ cm.
2. Outputs $32, 40$; add 8 each row.
3. All are even.
4. $(4, 6), (5, 5)$; first count rises by 1, second falls by 1, total stays 10.
5. Figure 2: 5; figure 3: 7; figure 5: 11 tiles.
6. Day 3; totals after days $1, 2, 3$ are $12, 16, 20$.
7. $5, 10, 15, 20$; step 5.
8. $11, 15, 19$; all stay odd, so the claim is false.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. After week 1: $11 + 3 = 14$ cm.

2. Next heights: $14 + 3 = 17$ cm, then $17 + 3 = 20$ cm.

Problem 2

1. The first outputs are $1 \times 8 = 8$, $2 \times 8 = 16$, $3 \times 8 = 24$.

2. The next are $4 \times 8 = 32$ and $5 \times 8 = 40$; each new group adds 8.

Problem 3

1. The totals are $6, 12, 18, 24$. The factor 6 is even.

2. Each total is a whole number of pairs because $6 = 2 \times 3$. Adding another 6 keeps the total even.

Problem 4

1. The first counts $1, 2, 3$ increase by 1; the second counts $9, 8, 7$ decrease by 1.

2. Continue with $4 + 6 = 10$ and $5 + 5 = 10$. One counter transfers between partners, so the combined total does not change.

Problem 5

1. The next figures contain $3 + 2 = 5$ and $5 + 2 = 7$ tiles.

2. Continue two more steps: $7 + 2 = 9$, $9 + 2 = 11$. Your drawings may change shape but must match these counts.

Problem 6

1. Day 1: $8 + 4 = 12$; day 2: $12 + 4 = 16$.

2. Day 3: $16 + 4 = 20$. Earlier totals are below 20, so day 3 is the first.

Problem 7

1. The total increase is $20 - 5 = 15$, spread over 3 equal jumps; $15 \div 3 = 5$.

2. Add that step: $5 + 5 = 10$, $10 + 5 = 15$, $15 + 5 = 20$.

Problem 8

1. The next totals are $7 + 4 = 11$, $11 + 4 = 15$, and $15 + 4 = 19$.

2. Adding 4 adds two pairs, so an unpaired point remains each time. An odd start plus even steps stays odd.

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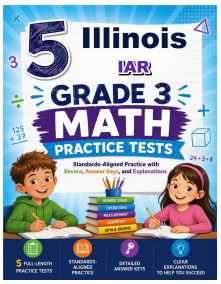

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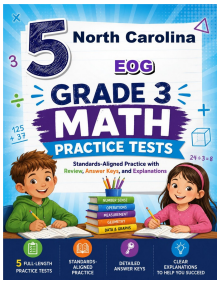

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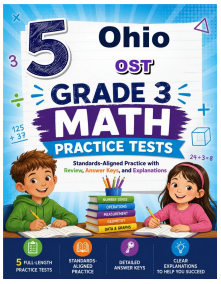

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